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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte ATSUSHI YABE, JUNNOSUKE SEKIGUCHI,
TORU IMORI, and YOSHIHISA FUJIHIRA

Appeal 2010-000891
Application 10/576,230
Technology Center 1700

Before PETER F. KRATZ, BEVERLY A. FRANKLIN, and
LINDA M. GAUDETTE, *Administrative Patent Judges*.

GAUDETTE, *Administrative Patent Judge*.

DECISION ON APPEAL¹

¹ The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, or for filing a request for rehearing, as recited in 37 C.F.R. § 41.52, begins to run from the “MAIL DATE” (paper delivery mode) or the “NOTIFICATION DATE” (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's decision finally rejecting claims 5 and 6, the only claims pending in the Application.² We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

Independent claim 6 and dependent claim 5 are representative of the invention and are reproduced below from the Claims Appendix to the Appeal Brief:

6. An electroless copper plating method comprising the steps of:
preparing a pretreatment agent by reacting or mixing a noble metal compound and a silane coupling agent having a functional group with metal-capturing capability;

pretreating a mirror surface having a surface roughness of less than 10 nm with the pretreatment agent prior to electroless copper plating;

performing electroless copper plating on the pretreated mirror surface with an electroless copper plating solution comprising a first reducing agent, hypophosphorous acid or a hypophosphite as a second reducing agent and a stabilizer for inhibiting copper deposition; and

forming a thin film having a thickness of no more than 500 nm on the pretreated mirror surface by the electroless copper plating.

5. An electroless copper plating method according to Claim 6, wherein the first reducing agent is glyoxylic acid, the second reducing agent is hypophosphorous acid and the stabilizer to inhibit copper deposition is 2,2'-bipyridyl.

² Appeal Brief filed Apr. 24, 2009 ("Br.").

Appellants request review of the following grounds of rejection (Br. 2):

1. Claim 6 under 35 U.S.C. § 103(a) as unpatentable over Kondo³ in view of Uzoh⁴, Maenosono⁵, and Imori⁶ (Ans.⁷ 3-6); and

2. Claim 5 under 35 U.S.C. § 103(a) as unpatentable over Kondo in view of Uzoh, Maenosono and Imori, and further in view of Yoshida⁸ and Verbunt⁹ (Ans. 6-8).

In traversing the rejection of claim 5, Appellants essentially rely on the arguments made in support of patentability of claim 6. (*See* Br. 8-9 (“Verbunt and Yoshida et al do not cure the deficiencies contained in the previously discussed Kondo et al, Uzoh et al, Maenosono and [Imori] references.”); Br. 9 (asserting, without explanation, that Example 2 provides objective evidence of nonobviousness).) These arguments raise the following issues¹⁰:

1. Did the Examiner reversibly err in determining that one of ordinary skill in the art would have had a reasonable expectation of success

³ US 4,834,796, issued May 30, 1989.

⁴ US 2003/0160326 A1, published Aug. 28, 2003.

⁵ US 2001/0021466 A1, published Sept. 13, 2001.

⁶ WO 0149898, published Dec. 7, 2001 (as translated).

⁷ Examiner’s Answer mailed Jul. 21, 2009.

⁸ US 2002/0011176 A1, published Jan. 31, 2002.

⁹ US 2004/0152303 A1, published Aug. 5, 2004.

¹⁰ Any remaining issues raised by Appellants have been fully addressed by the Examiner and are unpersuasive of error in the Examiner’s obviousness determination for the reasons explained in the Answer (*see e.g.*, Ans. 8-10 (regarding motivation to use a combination of formalin and sodium hypophosphite), and 14, ll. 1-7 (regarding adherency of Maenosono’s film layer)).

in applying the conventional plating techniques of the secondary references in Kondo's method? and

2. Did the Examiner err in determining that a preponderance of the evidence, taking into account Appellants' evidence of unexpected results, weighs in favor of obviousness?

We answer these questions in the negative for the reasons stated in the Answer and in the discussion that follows.

The Examiner finds that Kondo discloses the electroless copper plating method of appealed claim 6 with the exception of "coating of the mirror surface with the claimed surface roughness and the plating thickness of 500 nm or less, and the application of the noble metal/silane pretreatment agent before the electroless plating." (Ans. 4; *see* Br. 4 (providing essentially the same list of features absent in Kondo).) The Examiner notes Kondo teaches that conventional plating techniques can be used in the disclosed plating method. (Ans. 10.)

The Examiner relies on the secondary references as evidence of conventional plating techniques at the time of the invention. More specifically, the Examiner relies on Imori to establish that, at the time of the invention, "pretreatment of mirrored finish surfaces using the noble metal/silane (catalyst) [was] . . . a 'conventional' treatment." (Ans. 11.) Maenosono is cited for a teaching that it was well known in the art to plate or coat thin films on silicon wafers having a roughness of 10 nm or less by a variety of methods. (Ans. 13.) Uzoh is relied on for a teaching that it was conventional in the art to plate copper on a substrate by electroless or electroplating techniques for integrated circuit applications. (Ans. 12.)

Appellants contend these conventional treatments are intended for use on mirrored finish substrate surfaces and, therefore, one of ordinary skill in the art would not have had a reasonable expectation of success in applying these treatments in Kondo's electroless plating method, which requires roughened substrate surfaces. (Br. 5-7.)

We have reviewed Kondo's disclosure and are in agreement with the Examiner that Kondo's method is not limited to roughened substrate surfaces. Rather, Kondo merely identifies cleaning and chemically roughening as one example of a conventional pretreatment (*see* Kondo, col. 7, ll. 53-60, cited in Ans. 10). The Examiner has directed us to Kondo's examples, wherein Kondo describes using a stainless steel substrate which appears to have been cleaned, but not chemically roughened (Ans. 9-10 (citing Kondo, col. 9)). The Examiner has also directed us to the disclosure in Imori which supports a finding that it was known in the art at the time of the invention to electrolessly metal plate silicon wafers having a mirrored finish surface. (Imori¹¹ 5, 2nd para.) Appellants have not directly refuted these specific findings which support the Examiner's position that the ordinary artisan would have had a reasonable expectation of success in using mirrored finish substrate surfaces and conventional treatments of such surfaces in Kondo's electroless plating method.

Appellants also contend that Uzoh and Maenosono are directed to electrochemical deposition techniques and, therefore, one of ordinary skill in the art would not have had a reasonable expectation of success in applying the teachings of these references to Kondo's method which uses electroless plating techniques. (Br. 5-6.)

¹¹ Citations to Imori refer to the page numbers of the translation.

Appellants' argument with respect to Uzoh is based on Uzoh's inventive method which involves "electroplating copper on a semiconductor wafer to form copper interconnects" (Uzoh [0002]). Appellants have not directly refuted the Examiner's findings which are based on Uzoh's discussion of the prior art in the background section of the published application. We have reviewed the relied-upon disclosure and determine it supports the Examiner's finding that, at the time of Appellants' invention, the ordinary artisan would have understood "[c]opper may be plated by electroless or electroplating techniques on a substrate" (Ans. 12 (quoting Uzoh [0005])). Moreover, Appellants have not directly refuted the Examiner's finding that "Uzoh exemplifies [] a process for integrated circuits using a silicon wafer substrate and copper plating (with no limitation to electroless or electroplating)" (Ans. 12 (citing (Uzoh [0006]))). *See In re Bozek*, 416 F.2d 1385, 1390 (CCPA 1969) ("[A] reference disclosure must be evaluated for all that it fairly [teaches] and not only for what is indicated as preferred."); *see also, In re Fritch*, 972 F.2d 1260, 1264-65 (Fed. Cir. 1992).

With respect to Maenosono, we are in agreement with the Examiner that one of ordinary skill in the art would have had a reasonable expectation of success in electrolessly plating a substrate surface with a roughness of 10 nm or less as described in Maenosono based on Imori's disclosure (Ans. 13-14, bridging para.). Appellants have not addressed the Examiner's findings with respect to the understanding of the ordinary artisan when considering the *combined teachings* of Maenosono and Imori. (*See* Br. 6-7.)

In addition to arguing the Examiner has not established a *prima facie* case of obviousness, Appellants contend the Specification Examples and

Comparative Examples demonstrate unexpected results in using the claimed electroless copper plating solution as compared to plating solutions containing formalin or glyoxylic acid alone, or a plating solution without a stabilizer. (Br. 7.)

The Examiner relies on the following disclosure in Kondo in support of her determination that it would have been obvious to have used Appellants' claimed electroless copper plating solution in Kondo's method (Ans. 4):

[F]ormalin may be detrimental to the human body and cause instability of the bath when used in a large amount, and thus as little as possible should be used. For example, it is better if the amount of formalin is reduced and other reducing agents are jointly used, and the deposition rate is still increased. . . .

. . . .

. . . [I]t is certain that sodium hypophosphite, although it does not act alone, effectively accelerates the plating reaction if used in combination with formalin.

(Kondo, col. 13, ll. 32-38, col. 14, ll. 6-9.)

The above-cited disclosure supports the Examiner's contention that one of ordinary skill in the art would have been motivated to use a combination of formalin and sodium hypophosphite to achieve an improved deposition rate (*see* Ans. 9-10). Moreover, this evidence provides a strong *prima facie* showing of obviousness as to the claimed electroless copper plating solution for the reasons fully explained by the Examiner (Ans. 15-16). By contrast, Appellants' evidence of unexpected results does not appear to be commensurate in scope with the claims. For example, Appellants' claimed and comparative solutions were only tested on a single substrate (i.e., a silicon wafer having a 15 nm tantalum nitride film formed

thereon (Spec. [0032])¹²) and there was no variation in the amounts of reducing agents tested (*see* Spec. [0033-0042])¹³. For these reasons, we are in agreement with the Examiner that a preponderance of the evidence, taking into account Appellants' secondary considerations, weighs in favor of obviousness. *See Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1372 (Fed. Cir. 2007) (noting that evidence of secondary considerations does not always overcome a strong *prima facie* showing of obviousness).

In sum, for the reasons explained above and in the Answer, we are not persuaded of error in the Examiner's rejections of appealed claims 5 and 6. Accordingly, we sustain both grounds of rejection.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1).

AFFIRMED

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¹² *See* Spec. [0011] (identifying other suitable substrates).

¹³ *See* Spec. [0013-0014] (listing the ranges of preferred concentrations).